

Human Health and Performance Considerations for Exploration of Near-Earth Asteroids

Craig Kundrot,¹ Susan Steinberg,² and John Charles¹

¹Human Research Program, NASA Johnson Space Center (Houston, TX, USA) and ²Wyle Integrated Science and Engineering Group (Houston, TX, USA).

This presentation will describe the human health and performance issues that are anticipated for the human exploration of near-Earth asteroids (NEA). Humans are considered a system in the design of any such deep-space exploration mission, and exploration of NEA presents unique challenges for the human system. Key factors that define the mission are those that are strongly affected by distance and duration. The most critical of these is deep-space radiation exposure without even the temporary shielding of a nearby large planetary body. The current space radiation permissible exposure limits (PEL) restrict mission duration to 3-10 months depending on age and gender of crewmembers and stage of the solar cycle. Factors that affect mission architecture include medical capability; countermeasures for bone, muscle, and cardiovascular atrophy during continuous weightlessness; restricted food supplies; and limited habitable volume. The design of a habitat that can maintain the physical and psychological health of the crew and support mission operations with limited intervention from Earth will require an integrated research and development effort by NASA's Human Research Program, engineering, and human factors groups. Limited abort and return options for an NEA mission are anticipated to have important effects on crew psychology as well as influence medical supplies and training requirements of the crew. Other important factors are those related to isolation, confinement, communication delays, autonomous operations, task design, small crew size, and even the unchanging view outside the windows for most of the mission. Geological properties of the NEA will influence design of sample handling and containment, and extravehicular activity capabilities including suit ports and tools. A robotic precursor mission that collects basic information on NEA surface properties would reduce uncertainty about these aspects of the mission as well as aid in design of mission architecture and exploration tasks.

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